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ABSTRACT

An instrument was developed to determine the teacher's and student's educational objectives in the affective domain for high school biology. The 65 item attitude assessment scale was based on the same subject matter as "Biological Science: Molecules to Man," and structured according to Krathwohl, Bloom, and Masia's taxonomy. In a pilot study the scale was administered to eight teachers and their 640 students. Based on responses to the scale a profile of educational objectives in the affective domain was developed for each teacher and student. A statistical technique is described by which the profile of each teacher can be matched with the profile of each of his students. It is suggested that the instrument may be used to study transfer of objectives in the affective domain from teacher to students. (EB)

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ASSESSMENT OF AFFECTIVE OUTCOMES OF INSTRUCTION WITH HIGH SCHOOL SOPHOMORE BIOLOGY STUDENTS AND TEACHERS

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Assessment of Affective Outcomes of Instruction With High School Sophomore Biology Students and Teachers

PURPOSE

The purpose of this paper is twofold: it is to report on the development of an instrument to measure student and teacher 'attitudes' in the affective domain and to illustrate how profile or pattern analytic techniques can be used to meaningfully interpret such data.

INTRODUCTION

Recently several science educators have reported on the significance of the affective domain to science education. In a document prepared jointly by the Mid-continent Regional Educational Laboratory and the Biological Science Curriculum Study, affective behaviors are identified as important to success at inquiry (1). Esbensen (4) indicated that even though a student may possess the ability within the cognitive and psycomotor domains to do some task, his willingness to do a given task comes from the affective domain. Ramsey and Howe (10) in summarizing current research in instructional procedures in secondary school science state, "A student's attitudes toward science may well be more important than his understandings of science since his attitudes determine how he will use his know-

ledge. For this reason the development of attitudes as a part of science instruction is an area requiring increasing research."

Mager (8) indicates that a major objective in any educational situation should be that of having the student leave a teacher's influence with as favorable an attitude toward the subject as possible. Mager goes on to suggest that a favorable attitude will help maximize the possibility that the student will willingly learn more about what he has been taught. In 1960 Bruner (3) felt that the programs in science were providing experiences for school children that were influencing the development of the aforementioned affective outcomes.

DEVELOPMENT OF ATTITUDE INVENTORY

A search of the literature revealed that there is almost a complete absence of instruments to measure affective outcomes of instruction in the biological sciences. Thus it was necessary to develop an instrument which would measure affective outcomes of instruction in the biological sciences.

One hundred and thirty items which exemplified the content of the Biological Science Curriculum Study text, Biological Science: Molecules to Man (2) were developed. These items were then structured to agree with the five major divisions (13 subdivisions) of Krathwohl, Bloom, and Masia's Taxonomy of Educational Objectives, Handbook II: Affective Domain (7). A five point

Likert scale was used to measure responses to each item. The rationale for this type of scale is given in Oppenheim (9). The original pool of items was then reduced to 65 items through a process of testing and retesting with high school teachers and students who were enrolled in the science education program at the University of Iowa during the summer of 1969. The experimental version known as the Biology Attitude Assessment Scale is being field tested during the 1969-1970 school year with 602 sophomore biology students. The mean, variance, and standard deviation of each subtest for the pretest population of 602 students are given in Table 1.

A sample of items used in the experimental version of the Biology Attitude Assessment Scale follows:

1.0 RECEIVING

The biology student should . . .

. . . recognize that the behavior of an organism is affected by both internal and external stimuli.

. . . be willing to consider man's evolution.

. . . be sensitive to the importance of using a control in scientific investigations.

2.0 RESPONDING

The biology student should . . .

. . . follow the laboratory manual step-by-step

unless told to do otherwise.

. . . contribute to post-laboratory discussions by asking thought-provoking questions or supplying relevant data and ideas.

. . . find personal satisfaction in correctly responding to a question about spontaneous generation in class discussion.

3.0 VALUING

The biology student should . . .

. . . have a sense of responsibility for recording and reporting laboratory data correctly.

. . . assume an active role in searching for worthy news items of current interest in the biology class.

. . . develop strong feelings about some biological problems, e.g. the use of DDT, and should not be reluctant to display them to others.

4.0 ORGANIZATION

The biology student should . . .

. . . begin to form judgments as to the responsibility of society toward the implantation of organs from one being into another.

. . . develop a realistic acceptance of the modern views of evolution in accordance with his religious beliefs.

5.0 CHARACTERIZATION BY A VALUE OR VALUE COMPLEX

The biology student should . . .

> . . . judge problems in terms of experimental evidence rather than in terms of fixed, dogmatic precepts or emotionally wishful thinking.
>
> . . . develop for regulation of his personal and civic life a code of behavior based on ethical principles consistent with democratic ideals.

PROFILE ANALYSIS TECHNIQUES

Statistical techniques designed for data in the form of single scores are not appropriate when instruments reporting multiple scores are used because of a lack of statistical independence between subtests (6). As illustrated in Table 2 the data gathered from the Biology Attitude Assessment Scale is of this nature.

Haggard (5) has described a method whereby the simultaneous analysis of multiple score data is possible. In the method by Haggard any given set of scores can be compared with any other given set of scores. The result of the comparison of two sets of scores, a pattern, can be used, for example, to study the relationship between a teacher's profile and a given student's profile. A pattern may approach one of several ideal forms. If all the individuals constituting the group have the same score on

each subtest, and therefore have identical profiles, the set will be called a congruent pattern. If the scores on the various subtests differ by a constant, and thus give profiles which differ only in level, the set will be called a parallel pattern. But, if the profiles constituting the pattern overlap, as in the case of a random collection of scores, the set will be called a mixed pattern. And finally, when a set of scores is maximally dissimilar, the set will be called an incongruent pattern. The essence of a pattern is thus the relative position, both in level and in direction, of the scores in one profile as compared to those in another profile.

For congruent or parallel patterns $R_p = 1$; whereas for mixed or incongruent patterns R_p is some value less than one, including zero, where R_p is a measure or profile similarity expressed by the following formula (5, p. 105):

$$R_p = 1 - \left(\frac{IMS-1}{IMS}\right)$$

IMS is the interaction mean square where the number of scores per cell in the sample are > 1 in a two-way design.

This technique is currently being used in studies at the University of Iowa to analyze affective and cognitive outcomes of instruction when multiple score data is available for both the teacher and the student.

SUMMARY

The preliminary outcomes of this study are twofold. They appear to indicate that instruments can be developed to measure affective outcomes in education; they also indicate that the techniques of profile analysis, hitherto confined to medical and psychological studies, can be used in studies of a more general nature.

TABLE 1

MEAN, VARIANCE, AND STANDARD DEVIATION FOR
BIOLOGY ATTITUDE ASSESSMENT SCALE PRETEST POPULATION

	subtest				
	I	II	III	IV	V
$\bar{X}$	34.07	32.23	35.70	25.02	21.19
σ^2	44.40	52.18	47.42	25.14	24.07
sd	6.66	7.22	6.87	5.01	4.91

N=602

TABLE 2

INTERCORRELATIONS FOR BIOLOGY ATTITUDE ASSESSMENT SCALE SUBTESTS

	1	2	3	4	5
1	1.00	0.63	0.67	0.59	0.54
2		1.00	0.68	0.50	0.55
3			1.00	0.63	0.59
4				1.00	0.52
5					1.00

N=602

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